PATENT SPECIFICATION 1,082,988

DRAWINGS ATTACHED.

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1,082,988

Date of filing Complete Specification: Jan. 7, 1966.

Application Date: Dec. 22, 1964. No. 52014/64.

Complete Specification Published: Sept. 13, 1967.

Index at Acceptance:—B3 F(1G, 11U).

Int. Cl.:—B 22 d 15/00.

COMPLETE SPECIFICATION

Moulds.

We, THE BRITISH IRON AND STEEL RESEARCH ASSOCIATION, a British Company, of 24 Buckingham Gate, London, S.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to moulds particularly for the continuous casting of metals.

The continuous casting of metals may be effected in an open-ended mould into the upper end of which liquid metal is introduced and from the lower end of which the casting is progressively or intermittently withdrawn in partially solidified or solidified state.

It has been proposed to cool the mould by flowing coolant medium, for example water, through passages which are arranged in the material from which the mould is made.

One method of making the channels is to drill apertures around the mould cavity and because drilling long apertures of small diameter is difficult, the apertures are made of a larger diameter than is desirable for water flow conditions.

It is possible to insert in each aperture coaxially therewith a cylindrical rod or plug (sometimes called a displacement, or restrictor, rod and plug) to decrease the cooling water consumption of the mould system for a given flow velocity of the water. This method has the disadvantage of increasing the pressure needed to cause the water to flow through the mould and at the same time allows water to flow in that part of the annulus distant from the hot face of the mould where it contributes little to cooling the said hot face.

[*Price* 4*s.* 6*d.*]

It is an object of the invention to provide a mould having an improved cooling system which is nevertheless simple to manufacture.

According to the invention, there is provided a mould wherein a wall of the mould having a surface for contacting the material to be cast is provided with at least one passage disposed within the wall so that the passage extends in spaced relationship with said surface and is, in cross-section, completely surrounded by wall material for a major portion of the length of the passage, and wherein a restrictor rod is positioned in and extends along a major part of said passage, said rod being of a cross-section such that a major part of its periphery conforms to and is in contact with the periphery of said passage and such that the remaining part of its periphery is spaced from the periphery of said passage to form a space for the flow of a cooling medium along the length of the passage, said space being positioned on the side of the passage axis nearest the material-contacting surface to ensure optimum heat transfer from the surface to the medium.

Features and advantages of the present invention will appear from the following description of some embodiments given by way of example only, reference being had to the drawings accompanying the Provisional Specification. In the drawings:—

Figures 1 to 3 each comprise a longitudinal section through a mould wall;

Figures 4 and 5 are scrap longitudinal sections of plugs;

Figures 6 and 7 are respectively sections on the lines A—A and B—B of Figures 4 and 5;

Figures 8 and 9 are respectively a scrap longitudinal section of another embodiment

of mould wall and a section on the line C—C of Figure 8;

Figures 10 and 11 are longitudinal sections through further embodiments of mould wall;

Figures 12 to 14 are sections of spaces for the reception of a coolant medium; and

Figures 15 to 17 are transverse sections of further embodiments of plugs and spaces for the reception of a coolant medium.

The mould wall in each embodiment is indicated at 1 and the surface which will be in contact with the casting is shown at 2.

In each case a plurality of passages is bored in the mould wall at desired intervals about the mould cavity so that each passage extends in spaced relationship with surface 2 and is, in cross-section, completely surrounded by wall material for a major portion of the length of the passage; examples of such passages being indicated at 3 in the figures showing mould wall sections. In each passage is located a plug or restrictor rod 4 having a transverse section such that a major part of its periphery conforms to and is in contact with the periphery of the passage and such that the remaining part of its periphery is spaced from the passage periphery to form a space 5 for the flow of a cooling medium along the length of the passage, the space 5 being positioned on the side of the passage axis nearest the surface 2 to ensure optimum heat transfer from the surface to the medium.

To feed a coolant medium, for example, water to each channel there is provided in Figures 1, 2, 10 and 11 entry and exit drillings or conduits 6, 7.

In Figure 1 these drillings communicate with the channel 5 by way of passages or conduits 8 in the plug while in Figures 5 and 7 the plug has a recess 9 formed around its periphery to provide such communication. In Figure 3 the plug has a passage 8 at the inlet drilling and is slotted at 11 where the plug end lies clear of the outlet drilling 7. Any suitable arrangement is adopted to mount each plug. Projecting threaded plug ends 12, nuts 13 and sealing washers 14 are shown in Figure 1 while in Figures 2 and 3 expandable O[1] ring seals 15 are used in conjunction with tapered screw heads 16 to secure the plug. Figures 3 and 10 have the particular advantage that given the blind end 17 of the passage at the upper end of the mould there is no risk of leakage of coolant water at that end. The plug extends along the entire length, or at least the major part of the length, of the passage.

Figures 8 and 9 show two adjacent plugs served by common entry and exit slots or chambers, of which only the former 19 is shown, in the mould wall for the water. If desired, more than two plugs in appropriate passages may be provided.

By adoption of a plug section such that the plug is encompassed by more than half the passage circumference, the plug will be positively located along its whole length against movement transversely of the passage axis so avoiding the need for extra spacers or supports.

Each plug must be held against turning movement about the passage axis and this is achieved either by the clamping arrangements already referred to in Figures 1 to 3 or by a lock screw 20 as shown in Figure 10 or by a key 21 as shown in Figure 11 where the plug is held longitudinally by gaskets and end plates 22, 23.

Typical channel sections for the reception of water are shown in Figures 12 to 14.

An alternative method of construction to allow the water to flow as near the mould face as possible is to enlarge each passage by broaching to a greater cross-sectional area, to give a face of the passage nearest the inside of the mould which is substantially parallel to the mould contour. Examples of such constructions are shown in Figures 15 to 17, in each case the passage being indicated at 3[1], the plug at 4[1] and the channel at 5[1].

In each of the arrangements previously disclosed, it will be seen that the shortest path between each portion of each channel and the face 2 is unobstructed by the plug.

Any of the forms of cooling means disclosed herein may be employed in a continuous casting mould having a forming cavity having any one of the shapes disclosed in relation to our co-pending British Patent Application No. 18713/64 (Serial No. 1,049,698).

The plugs are easily removed for cleaning any blockages which may occur due to foreign bodies lodging in the water channels and it is also possible to replace the plugs with others to give different cross-sectional areas of the water channels, should this be desirable.

Although the invention has been described with particular reference to continuous casting moulds, it is to be understood that it may be used in relation with moulds other than continuous casting moulds.

WHAT WE CLAIM IS:—

1. A mould wherein a wall of the mould having a surface for contacting the material to be cast is provided with at least one passage disposed within the wall so that the passage extends in spaced relationship with said surface and is, in cross-section, completely surrounded by wall material for a major portion of the length of the passage, and wherein a restrictor rod is positioned in and extends along a major part

of said passage, said rod being of a cross-section such that a major part of its periphery conforms to and is in contact with the periphery of said passage and such that the remaining part of its periphery is spaced from the periphery of said passage to form a space for the flow of a cooling medium along the length of the passage, said space being positioned on the side of the passage axis nearest the material-contacting surface to ensure optimum heat transfer from the surface to the medium.

2. A mould according to claim 1 including means for allowing coolant medium communication between the space and a conduit formed in the wall.

3. A mould according to claim 2, wherein said communication means includes a conduit extending through the rod to the space, and wherein the conduit is in communication with the first mentioned conduit formed in the wall.

4. A mould according to claim 2, wherein said communication means includes a slotted portion of the rod extending to the space, and wherein the slotted portion co-operates with the conduit formed in the wall.

5. A mould according to claim 2, wherein said communication means includes a recess formed around the periphery of the rod and extending to the space, and wherein the recess co-operates with the conduit formed in the wall.

6. A mould according to claim 2, wherein there are at least two mutually spaced passages formed in the wall each having a rod positioned therein, and wherein there is a chamber formed in the wall, the chamber being common to and admitting to the spaces.

7. A mould according to any one of the preceding claims, including means for holding the, or each, rod longitudinally of the passage receiving it.

8. A mould according to any one of the preceding claims, including means for preventing rotation of the, or each rod relative to the passage receiving it.

9. A mould according to any one of the preceding claims, including sealing means for preventing escape of the coolant medium from the passage.

10. A mould according to any one of the preceding claims, and adapted to continuously cast metals.

11. A mould according to claim 10 having a forming cavity having any one of the shapes disclosed in British Patent Serial No. 1,049,698.

12. A mould substantially as herein described with reference to, and as illustrated in, any one of Figures 1 to 17 of the drawings accompanying the Provisional Specification.

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Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1967.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

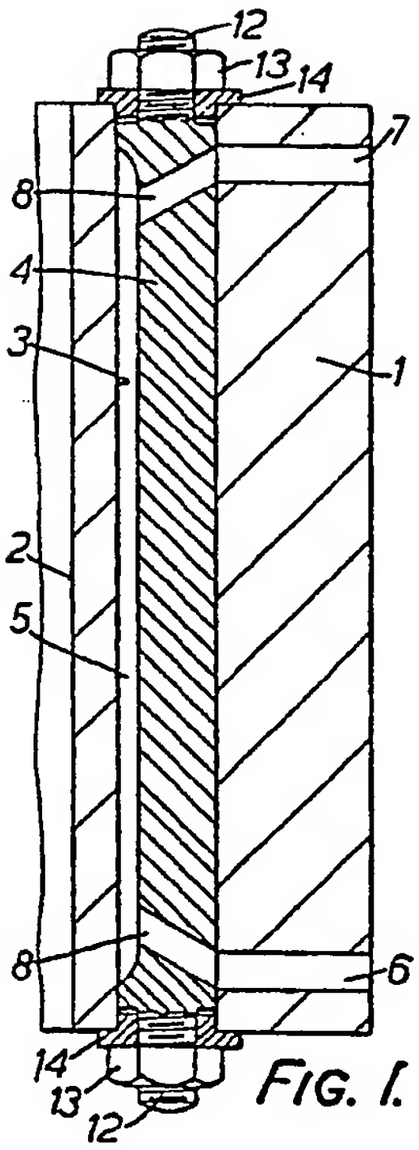


FIG. 1.

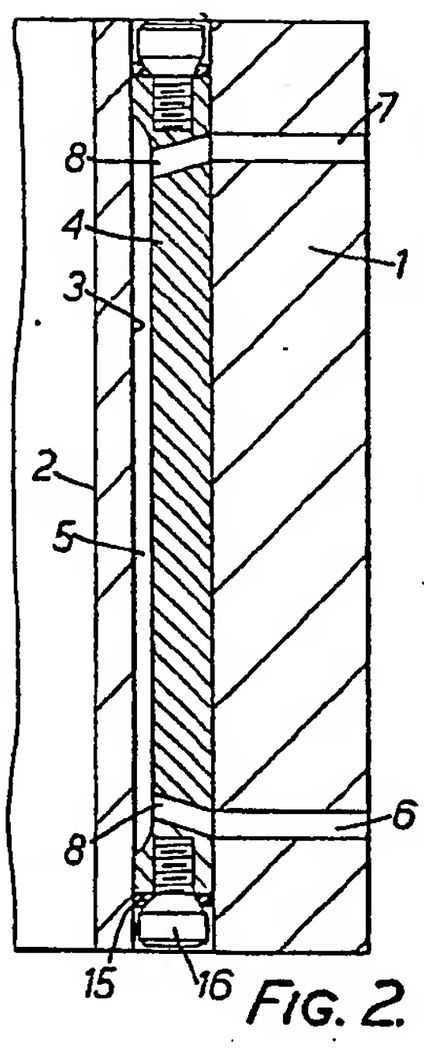


FIG. 2.

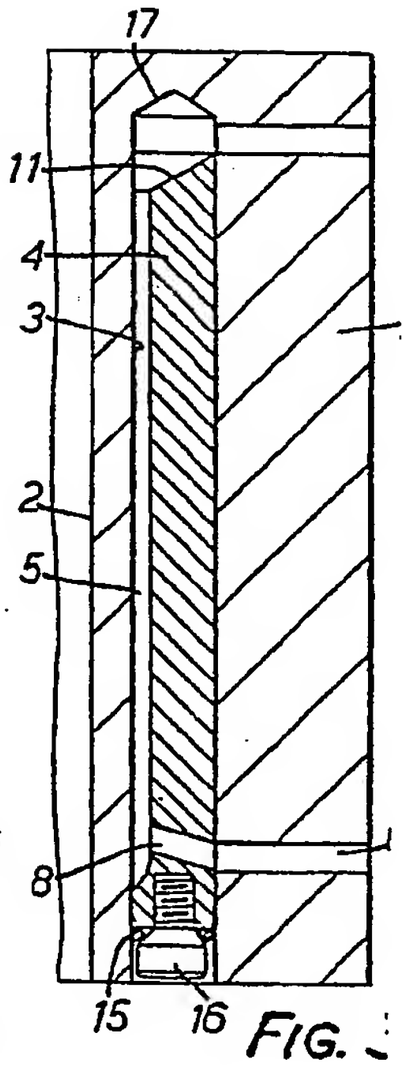


FIG. 3

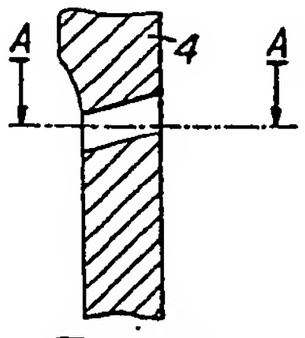


FIG. 4.

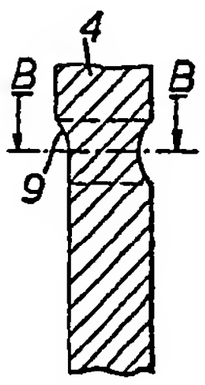


FIG. 5.

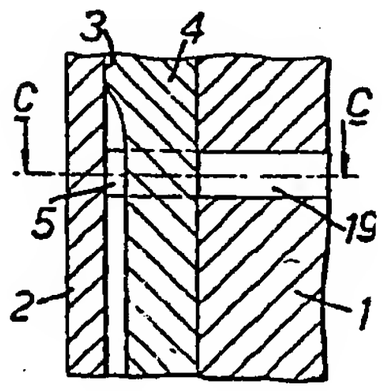


FIG. 8.

FIG. 6.

FIG 7

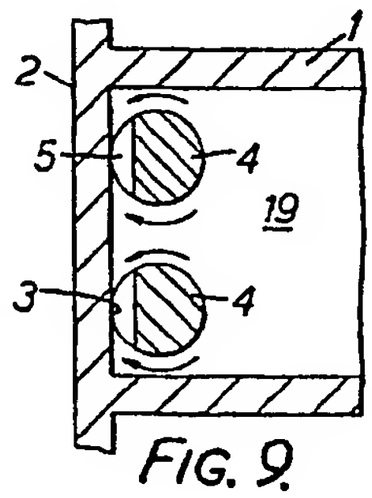


FIG. 9.

1082988 PROVISIONAL SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 1 & 2

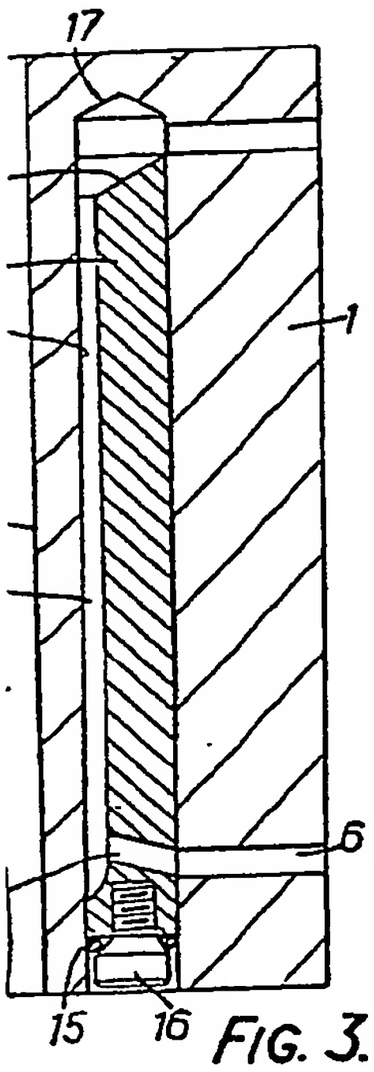


FIG. 3.

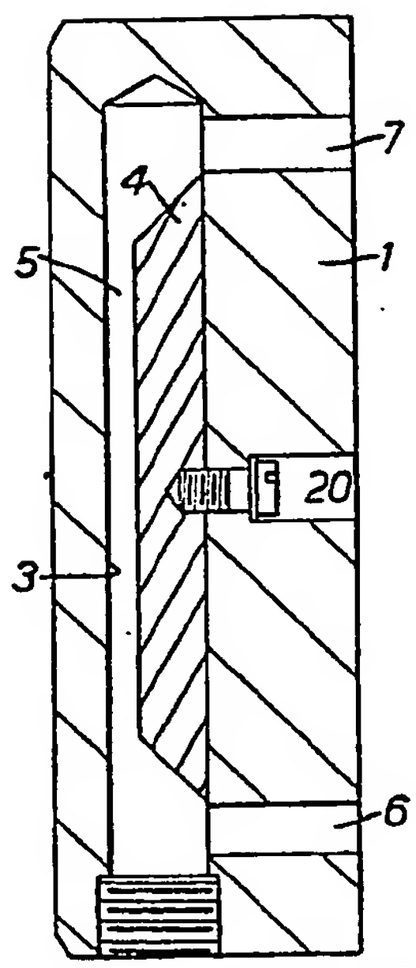


FIG. 10.

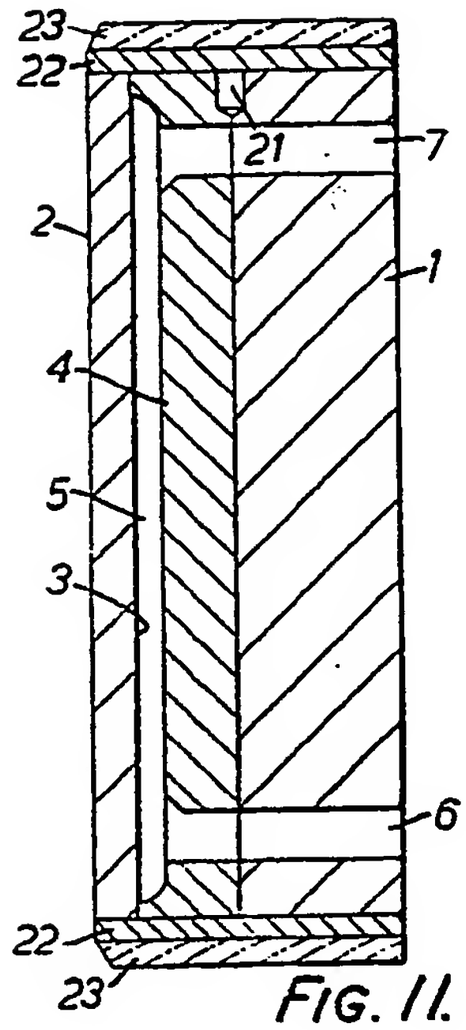
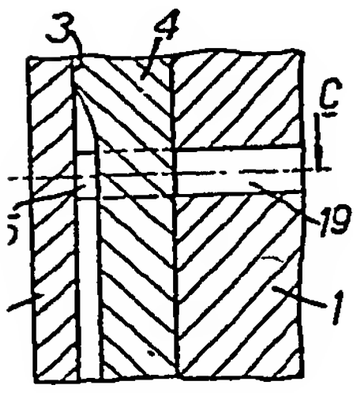


FIG. 11.



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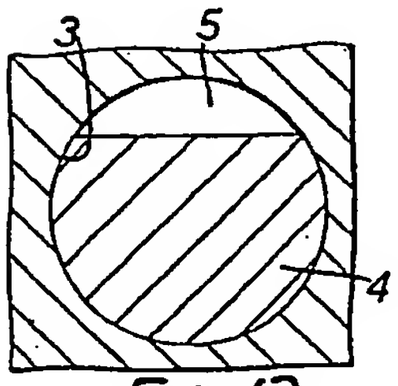

FIG. 12.

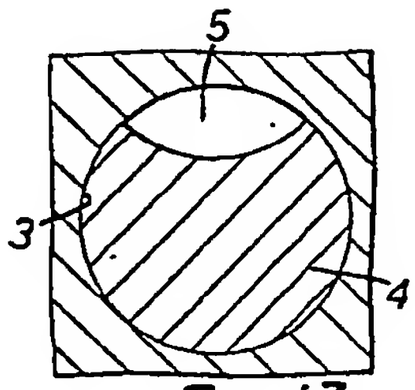

FIG. 13.

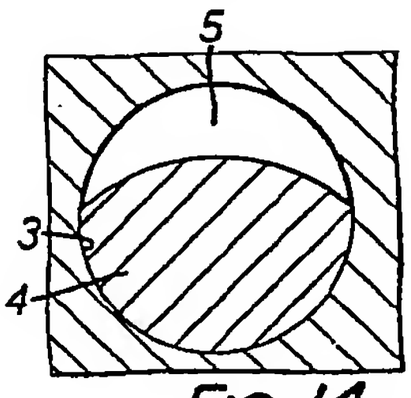

FIG. 14.

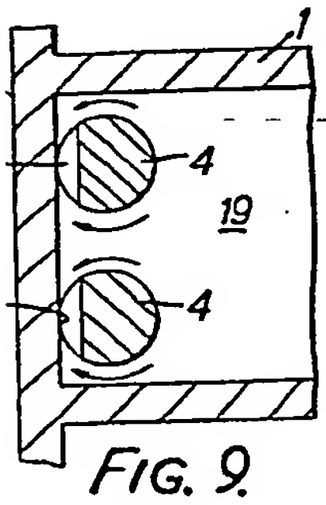

FIG. 9.

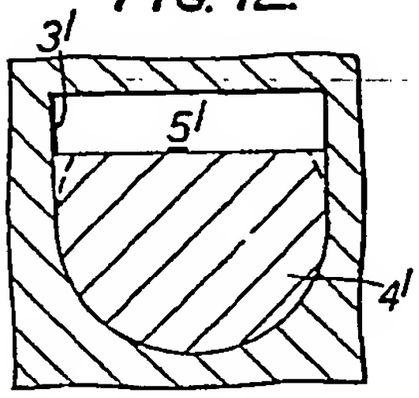

FIG. 15.

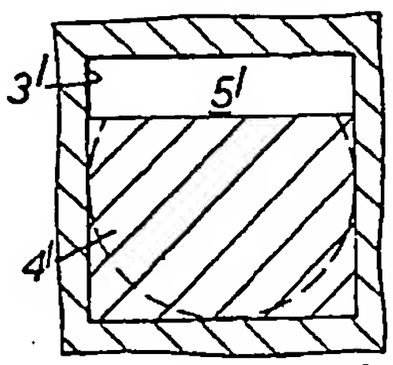

FIG. 16.

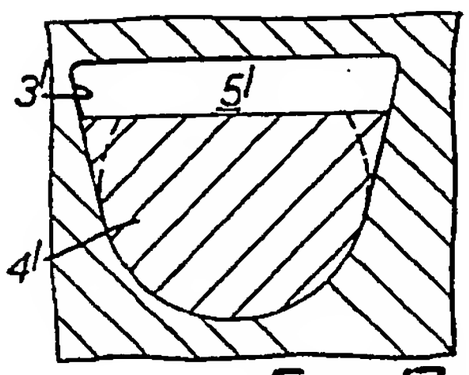

FIG. 17.

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2 SHEETS

PROVISIONAL SPECIFICATION

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Sheets 1 & 2

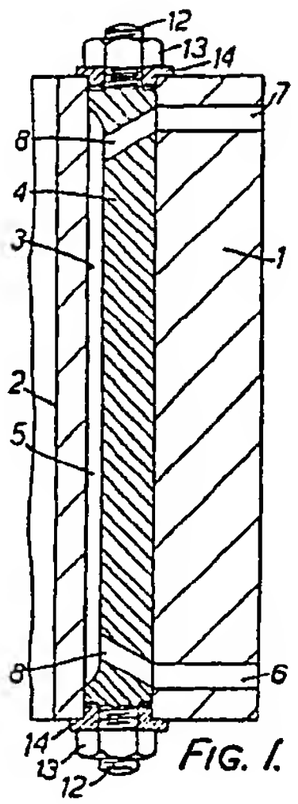
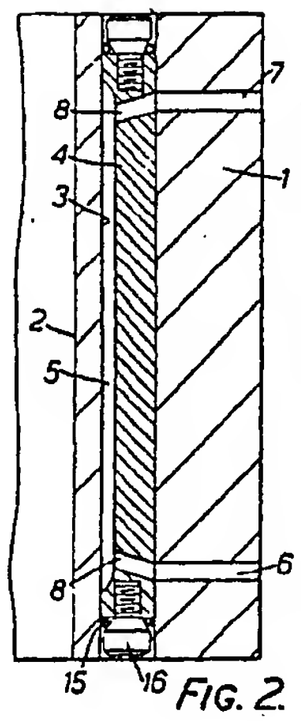


FIG. 1.



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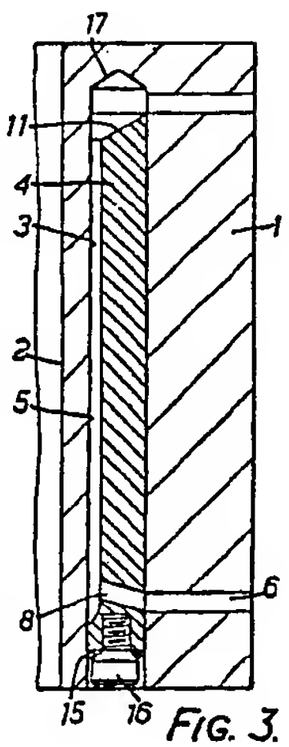
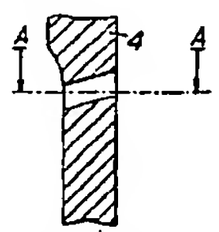


FIG. 3.



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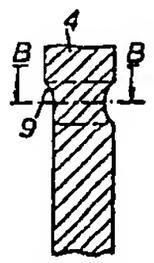

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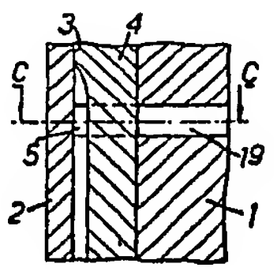
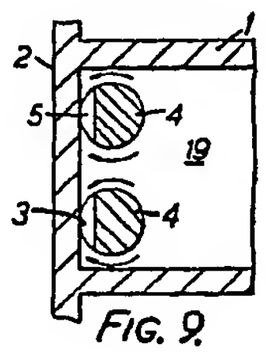


FIG. 8.

FIG. 6.

FIG 7



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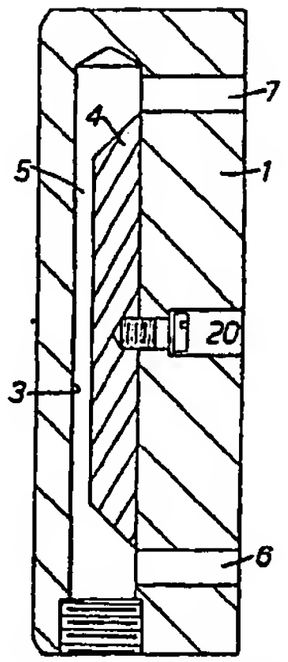

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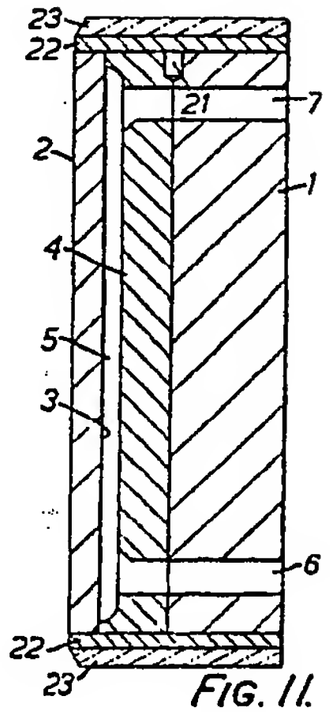

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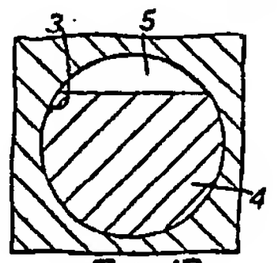

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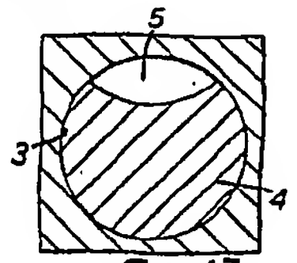

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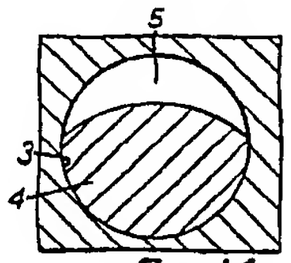

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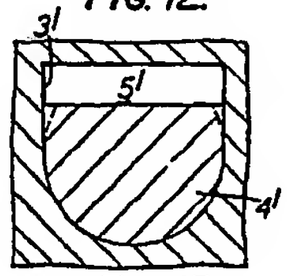
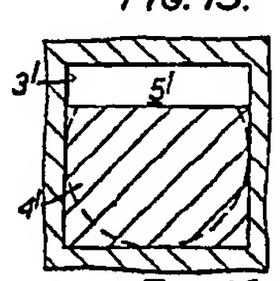


FIG. 15.



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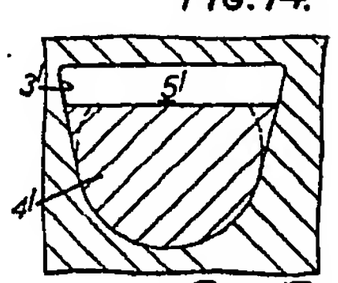

FIG. 17.